Postal (home)

Network Working Group
Request for Comments: 944

Obsoletes: RFCs 924, 901, 880, 840

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ISI
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OFFICIAL ARPA-INTERNET PROTOCOLS

STATUS OF THIS MEMO

This memo is an official status report on the protocols used in the ARPA-Internet community. Distribution of this memo is unlimited.

INTRODUCTION

This RFC identifies the documents specifying the official protocols used in the Internet. Comments indicate any revisions or changes planned.

To first order, the official protocols are those in the "Internet Protocol Transition Workbook" (IPTW) dated March 1982. There are several protocols in use that are not in the IPTW. A few of the protocols in the IPTW have been revised. Notably, the mail protocols have been revised and issued as a volume titled "Internet Mail Protocols" dated November 1982. Telnet and the most useful Telnet options have been revised and issued as a volume titled "Internet Telnet Protocol and Options" (ITP) dated June 1983. Some protocols have not been revised for many years, these are found in the old "ARPANET Protocol Handbook" (APH) dated January 1978. There is also a volume of protocol related information called the "Internet Protocol Implementers Guide" (IPIG) dated August 1982.

This document is organized as a sketchy outline. The entries are protocols (e.g., Transmission Control Protocol). In each entry there are notes on status, specification, comments, other references, dependencies, and contact.

The STATUS is one of: required, recommended, elective, or experimental.

The SPECIFICATION identifies the protocol defining documents.

The COMMENTS describe any differences from the specification or problems with the protocol.

The OTHER REFERENCES identify documents that comment on or expand on the protocol.

The DEPENDENCIES indicate what other protocols are called upon by this protocol.

The CONTACT indicates a person who can answer questions about the protocol.

In particular, the status may be:

required

- all hosts must implement the required protocol,

recommended

- all hosts are encouraged to implement the recommended protocol,

elective

- hosts may implement or not the elective protocol,

experimental

- hosts should not implement the experimental protocol unless they are participating in the experiment and have coordinated their use of this protocol with the contact person, and

none

- this is not a protocol.

For further information about protocols in general, please contact:

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OVERVIEW

Catenet Model ---

STATUS: None

SPECIFICATION: IEN 48 (in IPTW)

COMMENTS:

Gives an overview of the organization and principles of the Internet.

Could be revised and expanded.

OTHER REFERENCES:

RFC 871 - A Perspective on the ARPANET Reference Model

Padlipsky, M.A., "The Elements of Networking Style and other Essays and Animadversions on the Art of Intercomputer Networking", Prentice-Hall, New Jersey, 1985.

Leiner, Barry, Robert Cole, Jon Postel and Dave Mills, "The DARPA Protocol Suite", IEEE INFOCOM 85, Washington, D.C., March 1985. Also in IEEE Communications Magazine, March 1985.

DEPENDENCIES:

CONTACT: Postel@USC-ISIF.ARPA

NETWORK LEVEL

Internet Protocol -- (IP)

STATUS: Required

SPECIFICATION: RFC 791 (in IPTW)

COMMENTS:

This is the universal protocol of the Internet. This datagram protocol provides the universal addressing of hosts in the Internet.

A few minor problems have been noted in this document.

The most serious is a bit of confusion in the route options. The route options have a pointer that indicates which octet of the route is the next to be used. The confusion is between the phrases "the pointer is relative to this option" and "the smallest legal value for the pointer is 4". If you are confused, forget about the relative part, the pointer begins at 4.

Another important point is the alternate reassembly procedure suggested in RFC 815.

Some changes are in the works for the security option.

Note that ICMP is defined to be an integral part of IP. You have not completed an implementation of IP if it does not include ICMP.

OTHER REFERENCES:

RFC 815 (in IPIG) - IP Datagram Reassembly Algorithms

RFC 814 (in IPIG) - Names, Addresses, Ports, and Routes

RFC 816 (in IPIG) - Fault Isolation and Recovery

RFC 817 (in IPIG) - Modularity and Efficiency in Protocol Implementation

MIL-STD-1777 - Military Standard Internet Protocol

DEPENDENCIES:

CONTACT: Postel@USC-ISIF.ARPA

Internet Control Message Protocol ---------------------------- (ICMP)

STATUS: Required

SPECIFICATION: RFC 792 (in IPTW)

COMMENTS:

The control messages and error reports that go with the Internet Protocol.

A few minor errors in the document have been noted. Suggestions have been made for additional types of redirect message and additional destination unreachable messages.

A proposal for two additional ICMP message types is made in RFC 917 "Internet Subnets", Address Format Request (A1=17), and Address Format Reply (A2=18). The details of these ICMP types are subject to change. Use of these ICMP types is experimental.

Note that ICMP is defined to be an integral part of IP. You have not completed an implementation of IP if it does not include ICMP.

OTHER REFERENCES: RFC 917

DEPENDENCIES: Internet Protocol

CONTACT: Postel@USC-ISIF.ARPA

HOST LEVEL

User Datagram Protocol --------------------------------------- (UDP)

STATUS: Recommended

SPECIFICATION: RFC 768 (in IPTW)

COMMENTS:

Provides a datagram service to applications. Adds port addressing to the IP services.

The only change noted for the UDP specification is a minor clarification that if in computing the checksum a padding octet is used for the computation it is not transmitted or counted in the length.

OTHER REFERENCES:

DEPENDENCIES: Internet Protocol

CONTACT: Postel@USC-ISIF.ARPA

Transmission Control Protocol -------------------------------- (TCP)

STATUS: Recommended

SPECIFICATION: RFC 793 (in IPTW)

COMMENTS:

Provides reliable end-to-end data stream service.

Many comments and corrections have been received for the TCP specification document. These are primarily document bugs rather than protocol bugs.

Event Processing Section: There are many minor corrections and clarifications needed in this section.

Push: There are still some phrases in the document that give a "record mark" flavor to the push. These should be further clarified. The push is not a record mark.

Urgent: Page 17 is wrong. The urgent pointer points to the last octet of urgent data (not to the first octet of non-ungent data).

Listening Servers: Several comments have been received on difficulties with contacting listening servers. There should be some discussion of implementation issues for servers, and some notes on alternative models of system and process organization for servers.

Maximum Segment Size: The maximum segment size option should be generalized and clarified. It can be used to either increase or decrease the maximum segment size from the default. The TCP Maximum Segment Size is the IP Maximum Datagram Size minus forty. The default IP Maximum Datagram Size if 576. The default TCP Maximum Segment Size is 536. For further discussion, see RFC 879.

Idle Connections: There have been questions about automatically closing idle connections. Idle connections are ok, and should not be closed. There are several cases where idle connections arise, for example, in Telnet when a user is thinking for a long time following a message from the server computer before his next input. There is no TCP "probe" mechanism, and none is needed.

Queued Receive Data on Closing: There are several points where it is not clear from the description what to do about data received by the TCP but not yet passed to the user, particularly when the connection is being closed. In general, the data is to be kept to give to the user if he does a RECV call.

Out of Order Segments: The description says that segments that arrive out of order, that is, are not exactly the next segment to be processed, may be kept on hand. It should also point out that there is a very large performance penalty for not doing so.

User Time Out: This is the time out started on an open or send call. If this user time out occurs the user should be notified, but the connection should not be closed or the TCB deleted. The user should explicitly ABORT the connection if he wants to give up.

OTHER REFERENCES:

RFC 813 (in IPIG) - Window and Acknowledgement Strategy in TCP

RFC 814 (in IPIG) - Names, Addresses, Ports, and Routes

RFC 816 (in IPIG) - Fault Isolation and Recovery

RFC 817 (in IPIG) - Modularity and Efficiency in Protocol Implementation

RFC 879 - TCP Maximum Segment Size

RFC 889 - Internet Delay Experiments

RFC 896 - TCP/IP Congestion Control

MIL-STD-1778 - Military Standard Transmission Control Protocol

DEPENDENCIES: Internet Protocol

CONTACT: Postel@USC-ISIF.ARPA

Host Monitoring Protocol --------------------------------------- (HMP)

STATUS: Elective

SPECIFICATION: RFC 869

COMMENTS:

This is a good tool for debugging protocol implementations in remotely located computers.

This protocol is used to monitor Internet gateways and the TACs.

OTHER REFERENCES:

DEPENDENCIES: Internet Protocol

CONTACT: Hinden@BBN-UNIX.ARPA

Cross Net Debugger -- (XNET)

STATUS: Elective

SPECIFICATION: IEN 158

COMMENTS:

A debugging protocol, allows debugger like access to remote systems.

This specification should be updated and reissued as an RFC.

OTHER REFERENCES: RFC 643

DEPENDENCIES: Internet Protocol

CONTACT: Postel@USC-ISIF.ARPA

"Stub" Exterior Gateway Protocol ------------------------------ (EGP)

STATUS: Recommended for Gateways

SPECIFICATION: RFC 888, RFC 904

COMMENTS:

The protocol used between gateways of different administrations to exchange routing information.

Please discuss any plans for implementation or use of this protocol with the contact.

OTHER REFERENCES: RFC 827, RFC 890

DEPENDENCIES: Internet Protocol

CONTACT: Mills@USC-ISID.ARPA

Gateway Gateway Protocol -------------------------------------- (GGP)

STATUS: Experimental

SPECIFICATION: RFC 823

COMMENTS:

The gateway protocol now used in the core gateways.

Please discuss any plans for implementation or use of this protocol with the contact.

OTHER REFERENCES:

DEPENDENCIES: Internet Protocol

CONTACT: Brescia@BBN-UNIX.ARPA

Multiplexing Protocol --------------------------------------- (MUX)

STATUS: Experimental

SPECIFICATION: IEN 90

COMMENTS:

Defines a capability to combine several segments from different higher level protocols in one IP datagram.

No current experiment in progress. There is some question as to the extent to which the sharing this protocol envisions can actually take place. Also, there are some issues about the information captured in the multiplexing header being (a) insufficient, or (b) over specific.

Please discuss any plans for implementation or use of this protocol with the contact.

OTHER REFERENCES:

DEPENDENCIES: Internet Protocol

CONTACT: Postel@USC-ISIF.ARPA

Stream Protocol -- (ST)

STATUS: Experimental

SPECIFICATION: IEN 119

COMMENTS:

A gateway resource allocation protocol designed for use in multihost real time applications.

The implementation of this protocol has evolved and may no longer be consistent with this specification. The document should be updated and issued as an RFC.

Please discuss any plans for implementation or use of this protocol with the contact.

OTHER REFERENCES:

DEPENDENCIES: Internet Protocol

CONTACT: jwf@LL-EN.ARPA

Network Voice Protocol ------------------------------------ (NVP-II)

STATUS: Experimental

SPECIFICATION: ISI Internal Memo

COMMENTS:

Defines the procedures for real time voice conferencing.

The specification is an ISI Internal Memo which should be updated and issued as an RFC.

Please discuss any plans for implementation or use of this protocol with the contact.

OTHER REFERENCES: RFC 741

DEPENDENCIES: Internet Protocol, Stream Protocol

CONTACT: Casner@USC-ISIB.ARPA

Reliable Data Protocol -- (RDP)

STATUS: Experimental

SPECIFICATION: RFC 908

COMMENTS:

This protocol is designed to efficiently support the bulk transfer of data for such host monitoring and control applications as loading/dumping and remote debugging. The protocol is intended to be simple to implement but still be efficient in environments where there may be long transmission delays and loss or non-sequential delivery of message segments.

OTHER REFERENCES:

DEPENDENCIES: Internet Protocol

CONTACT: CWelles@BBN-UNIX.ARPA

Internet Reliable Transaction Protocol --------------------- (IRTP)

STATUS: Experimental

SPECIFICATION: RFC 938

COMMENTS:

This protocol is a transport level host to host protocol designed for an internet environment. While the issues discussed may not be directly relevant to the research problems of the DARPA community, they may be interesting to a number of researchers and implementors.

OTHER REFERENCES:

DEPENDENCIES: Internet Protocol

CONTACT: Trudy@ACC.ARPA

APPLICATION LEVEL

Telnet Protocol -- (TELNET)

STATUS: Recommended

SPECIFICATION: RFC 854 (in "Internet Telnet Protocol and Options")

COMMENTS:

The protocol for remote terminal access.

This has been revised since the IPTW. RFC 764 in IPTW is now obsolete.

OTHER REFERENCES:

MIL-STD-1782 - Telnet Protocol

DEPENDENCIES: Transmission Control Protocol

CONTACT: Postel@USC-ISIF.ARPA

Telnet Options ------------------------------------ (TELNET-OPTIONS)

STATUS: Elective

SPECIFICATION: General description of options: RFC 855
(in "Internet Telnet Protocol and Options")

Number	Name	RFC	NIC	ITP	APH	USE
0	Binary Transmission	856	-----	yes	obs	yes
1	Echo	857	-----	yes	obs	yes
2	Reconnection	...	15391	no	yes	no
3	Suppress Go Ahead	858	-----	yes	obs	yes
4	Approx Message Size Negotiation	...	15393	no	yes	no
5	Status	859	-----	yes	obs	yes
6	Timing Mark	860	-----	yes	obs	yes
7	Remote Controlled Trans and Echo	726	39237	no	yes	no
8	Output Line Width	...	20196	no	yes	no
9	Output Page Size	...	20197	no	yes	no
10	Output Carriage-Return Disposition	652	31155	no	yes	no
11	Output Horizontal Tabstops	653	31156	no	yes	no
12	Output Horizontal Tab Disposition	654	31157	no	yes	no
13	Output Formfeed Disposition	655	31158	no	yes	no
14	Output Vertical Tabstops	656	31159	no	yes	no
15	Output Vertical Tab Disposition	657	31160	no	yes	no
16	Output Linefeed Disposition	658	31161	no	yes	no
17	Extended ASCII	698	32964	no	yes	no
18	Logout	727	40025	no	yes	no
19	Byte Macro	735	42083	no	yes	no
20	Data Entry Terminal	732	41762	no	yes	no
21	SUPDUP	734 736	42213	no	yes	no
22	SUPDUP Output	749	45449	no	no	no
23	Send Location	779	-----	no	no	no
24	Terminal Type	930	-----	no	no	no
25	End of Record	885	-----	no	no	no
26	TACACS User Identification	927	-----	no	no	no
27	Output Marking	933	-----	no	no	no
255	Extended-Options-List	861	-----	yes	obs	yes

(obs = obsolete)

The ITP column indicates if the specification is included in the Internet Telnet Protocol and Options. The APH column indicates if the specification is included in the ARPANET Protocol Handbook. The USE column of the table above indicates which options are in general use.

COMMENTS:

The Binary Transmission, Echo, Suppress Go Ahead, Status, Timing Mark, and Extended Options List options have been recently updated and reissued. These are the most frequently implemented options.

The remaining options should be reviewed and the useful ones should be revised and reissued. The others should be eliminated.

The following are recommended: Binary Transmission, Echo, Suppress Go Ahead, Status, Timing Mark, and Extended Options List.

OTHER REFERENCES:

DEPENDENCIES: Telnet

CONTACT: Postel@USC-ISIF.ARPA

File Transfer Protocol --------------------------------------- (FTP)

STATUS: Recommended

SPECIFICATION: RFC 765 (in IPTW)

COMMENTS:

The protocol for moving files between Internet hosts. Provides for access control and negotiation of file parameters.

There are a number of minor corrections to be made. A major change is the deletion of the mail commands, and a major clarification is needed in the discussion of the management of the data connection. Also, a suggestion has been made to include some directory manipulation commands (RFC 775).

Even though the MAIL features are defined in this document, they are not to be used. The SMTP protocol is to be used for all mail service in the Internet.

Data Connection Management:

a. Default Data Connection Ports: All FTP implementations must support use of the default data connection ports, and only the User-PI may initiate the use of non-default ports.

b. Negotiating Non-Default Data Ports: The User-PI may specify a non-default user side data port with the PORT command. The User-PI may request the server side to identify a non-default server side data port with the PASV command. Since a connection is defined by the pair of addresses, either of these actions is enough to get a different data connection, still it is permitted to do both commands to use new ports on both ends of the data connection.

c. Reuse of the Data Connection: When using the stream mode of data transfer the end of the file must be indicated by closing the connection. This causes a problem if multiple files are to be transfered in the session, due to need for TCP to hold the connection record for a time out period to guarantee the reliable communication. Thus the connection can not be reopened at once.

There are two solutions to this problem. The first is to negotiate a non-default port (as in (b) above). The second is to use another transfer mode.

A comment on transfer modes. The stream transfer mode is inherently unreliable, since one can not determine if the connection closed prematurely or not. The other transfer modes (Block, Compressed) do not close the connection to indicate the end of file. They have enough FTP encoding that the data connection can be parsed to determine the end of the file. Thus using these modes one can leave the data connection open for multiple file transfers.

Why this was not a problem with the old NCP FTP:

The NCP was designed with only the ARPANET in mind. The ARPANET provides very reliable service, and the NCP counted on it. If any packet of data from an NCP connection were lost or damaged by the network the NCP could not recover. It is a tribute to the ARPANET designers that the NCP FTP worked so well.

The TCP is designed to provide reliable connections over many different types of networks and interconnections of networks. TCP must cope with a set of networks that can not promise to work as well as the ARPANET. TCP must make its own provisions for end-to-end recovery from lost or damaged packets. This leads to the need for the connection phase-down time-out. The NCP never had to deal with acknowledgements or retransmissions or many other things the TCP must do to make connection reliable in a more complex world.

LIST and NLST:

There is some confusion about the LIST an NLST commands, and what is appropriate to return. Some clarification and motivation for these commands should be added to the specification.

Multiple 1xx Replies:

There is some difference of opinion about the use of multiple 1xx responses during command processing. This issue comes up particularly in processing the RETR and STOR commands. The two opinions are summarized below.

For Exactly One 1xx Response:

When a RETR or SEND command is started, the server is supposed to give an "intermediate reply" of 1xx when it is opening the data connection. Currently, some FTP servers give two 1xx messages. This causes problems for single-thread FTP user implementations. After reading the first intermediate reply, they go off to do the transfer. The second 1xx message is not seen until the end of the transfer. The RFC gives a state diagram of the form:

```
   --------->Wait--------->
           /      \
           ↑      |
           |      V
           \      /
            <-----
```

This implies any number of 1xx's (including 0). There is a suspicion that this is just sloppy diagraming, and that the intent is clear from other parts of the RFC.

The FTP specification states that the reason for intermediate replies is to allow implementations that can't do any better to know when to stop listening to the control channel and switch their attention to the data channel. Given this intent, it seems clear that there should be exactly one 1xx reply at the start of the transfer.

The FTP specification is ambiguous in this regard. The state diagrams appear to sanction any number of responses. But the charts before them do not. And from the intent, it seems obvious that exactly one is the right thing.

Consider an implementation on a PC. It is fairly hard to do parallel processing there. It should be possible for a PC implementation to stop paying attention to the control channel and start reading the file from the data channel when he sees the 1xx response. The only way this can work is if there is only one 1xx response.

Of course, one could make it a requirement that every FTP implementation must be based on good enough interrupt technology so that it can field extra responses during the transfer. But what would such a constraint buy? Just the ability to have both a 125 and a 150 response. It doesn't seem worth the price. You could just as well combine the information in those responses into a single one.

For Multiple 1xx Responses:

The multiple 1xx messages arose because the new TCP specification omitted the 050 spontaneous reply code. A solution was to change an 050 informational message to a 1xx message, creating both a 125 and a 150.

The state diagrams clearly allow this, and the "Command-Reply Sequences" section does not contradict it. A multiple 1xx implementation is in accord with the formal reply specifications.

A multiple 1xx implementation works with the TOPS-20 FTP's and with a number of different UNIX implementations, and the LOCUS system. So, a lot of implementors must follow state diagrams in preference to prose.

However, the observation is certainly correct that page 34 of the specification suggests that 1xx replies can be used by single-thread user implementations to switch attention to the data connection. This would allow only a single 1xx message, in contradiction to the state diagrams. It seems a bit strong, however, to call the one sentence on page 34 "the intent" of the specification, since it is contradicted by the format specification of replies.

A side discussion favoring more status information:

One view has always assumed a two-thread implementation. In this view, most user implementations are deficient because they do not allow the user to enter a STATUS command during data transfer. A cynic might say that is because the Computer Scientists who did these implementations only do "Toy" file transfers, and often use "Toy" operating systems.

There has been some complaints from the Toy systems crowd recently that FTP is too complicated. Well, it may be too complicated for Toy systems, but in fact it is too simple for many Real file systems. For example, it has no way to encode a "library" (i.e., a named collection of subfiles). It is (barely) adequate for shipping around files of text, but not much more.

With the notable exception of Multics and UNIX, many operating systems support complex file structures of which the user must be aware. One is not doing the user a favor by hiding details that may reach out and bite him. That is the reason some FTPs put out a large informative message at the beginning of the transfer, specifying the file baroqueness that is involved. As a Computer Scientist, you may find that message annoying, but if you had to use MVS very much, you would find it helpful, informative, and maybe even reassuring. Some believe that as DARPA technology moves into the production environment of DDN, there will be user requirements for such informative messages for a variety of vendor operating systems.

To provide important information to the user the specification should either allow multiple 1xx messages, or restore the old spontaneous reply category. In fact, the latter is preferable; this information should be displayed to the user, but a user FTP might swallow 1xx messages without displaying their text.

The Answer:

Following the Robustness Principle (a protocol implementation ought to inflict minimal pain and accept maximal pain) there should be only one 1xx response. That is, those FTP servers that now issue two 1xx responses should combine them.

OTHER REFERENCES:

RFC 678 - Document File Format Standards

MIL-STD-1780 - File Transfer Protocol

DEPENDENCIES: Transmission Control Protocol

CONTACT: Postel@USC-ISIF.ARPA

Trivial File Transfer Protocol ---------------------------------- (TFTP)

STATUS: Elective

SPECIFICATION: RFC 783 (in IPTW)

COMMENTS:

A very simple file moving protocol, no access control is provided.

This is in use in several local networks.

Ambiguities in the interpretation of several of the transfer modes should be clarified, and additional transfer modes could be defined. Additional error codes could be defined to more clearly identify problems.

OTHER REFERENCES:

DEPENDENCIES: User Datagram Protocol

CONTACT: Postel@USC-ISIF.ARPA

Simple File Transfer Protocol ------------------------------- (SFTP)

STATUS: Experimental

SPECIFICATION: RFC 913

COMMENTS:

SFTP is a simple file transfer protocol. It fills the need of people wanting a protocol that is more useful than TFTP but easier to implement (and less powerful) than FTP. SFTP supports user access control, file transfers, directory listing, directory changing, file renaming and deleting.

SFTP can be implemented with any reliable 8-bit byte stream oriented protocol, this document describes its TCP specification. SFTP uses only one TCP connection; whereas TFTP implements a connection over UDP, and FTP uses two TCP connections (one using the TELNET protocol).

Please discuss any plans for implementation or use of this protocol with the contact.

OTHER REFERENCES:

DEPENDENCIES: Transmission Control Protocol

CONTACT: MKL@MIT-XX.ARPA

Simple Mail Transfer Protocol ---------------------------------- (SMTP)

STATUS: Recommended

SPECIFICATION: RFC 821 (in "Internet Mail Protocols")

COMMENTS:

The procedure for transmitting computer mail between hosts.

This has been revised since the IPTW, it is in the "Internet Mail Protocols" volume of November 1982. RFC 788 (in IPTW) is obsolete.

There have been many misunderstandings and errors in the early implementations. Some documentation of these problems can be found in the file [ISIF]<SMTP>MAIL.ERRORS.

Some minor differences between RFC 821 and RFC 822 should be resolved.

OTHER REFERENCES:

RFC 822 - Mail Header Format Standards

This has been revised since the IPTW, it is in the "Internet Mail Protocols" volume of November 1982. RFC 733 (in IPTW) is obsolete. Further revision of RFC 822 is needed to correct some minor errors in the details of the specification.

MIL-STD-1781 - Simple Mail Transfer Protocol (SMTP)

DEPENDENCIES: Transmission Control Protocol

CONTACT: Postel@USC-ISIF.ARPA

Resource Location Protocol ------------------------------------- (RLP)

STATUS: Elective

SPECIFICATION: RFC 887

COMMENTS:

A resource location protocol for use in the ARPA-Internet. This protocol utilizes the User Datagram Protocol (UDP) which in turn calls on the Internet Protocol to deliver its datagrams.

OTHER REFERENCES:

DEPENDENCIES: User Datagram Protocol

CONTACT: Accetta@CMU-CS-A.ARPA

Loader Debugger Protocol --------------------------------------- (LDP)

STATUS: Experimental

SPECIFICATION: RFC 909

COMMENTS:

Specifies a protocol for loading, dumping and debugging target machines from hosts in a network environment. It is also designed to accommodate a variety of target CPU types. It provides a powerful set of debugging services, while at the same time, it is structured so that a simple subset may be implemented in applications like boot loading where efficiency and space are at a premium.

OTHER REFERENCES:

DEPENDENCIES: Reliable Data Protocol

CONTACT: Hinden@BBN-UNIX.ARPA

Remote Job Entry -- (RJE)

STATUS: Elective

SPECIFICATION: RFC 407 (in APH)

COMMENTS:

The general protocol for submitting batch jobs and retrieving the results.

Some changes needed for use with TCP.

No known active implementations.

OTHER REFERENCES:

DEPENDENCIES: File Transfer Protocol
Transmission Control Protocol

CONTACT: Postel@USC-ISIF.ARPA

Remote Job Service -- (NETRJS)

STATUS: Elective

SPECIFICATION: RFC 740 (in APH)

COMMENTS:

A special protocol for submitting batch jobs and retrieving the results used with the UCLA IBM OS system.

Please discuss any plans for implementation or use of this protocol with the contact.

Revision in progress.

OTHER REFERENCES:

DEPENDENCIES: Transmission Control Protocol

CONTACT: Braden@UCLA-CCN.ARPA

Remote Telnet Service -- (RTELNET)

STATUS: Elective

SPECIFICATION: RFC 818

COMMENTS:

Provides special access to user Telnet on a remote system.

OTHER REFERENCES:

DEPENDENCIES: Telnet, Transmission Control Protocol

CONTACT: Postel@USC-ISIF.ARPA

Graphics Protocol --- (GRAPHICS)

STATUS: Elective

SPECIFICATION: NIC 24308 (in APH)

COMMENTS:

The protocol for vector graphics.

Very minor changes needed for use with TCP.

No known active implementations.

OTHER REFERENCES:

DEPENDENCIES: Telnet, Transmission Control Protocol

CONTACT: Postel@USC-ISIF.ARPA

Echo Protocol -- (ECHO)

STATUS: Recommended

SPECIFICATION: RFC 862

COMMENTS:

Debugging protocol, sends back whatever you send it.

OTHER REFERENCES:

DEPENDENCIES: Transmission Control Protocol
or User Datagram Protocol

CONTACT: Postel@USC-ISIF.ARPA

Discard Protocol -- (DISCARD)

STATUS: Elective

SPECIFICATION: RFC 863

COMMENTS:

Debugging protocol, throws away whatever you send it.

OTHER REFERENCES:

DEPENDENCIES: Transmission Control Protocol
or User Datagram Protocol

CONTACT: Postel@USC-ISIF.ARPA

Character Generator Protocol ---------------------------- (CHARGEN)

STATUS: Elective

SPECIFICATION: RFC 864

COMMENTS:

Debugging protocol, sends you ASCII data.

OTHER REFERENCES:

DEPENDENCIES: Transmission Control Protocol
or User Datagram Protocol

CONTACT: Postel@USC-ISIF.ARPA

Quote of the Day Protocol ---------------------------------- (QUOTE)

STATUS: Elective

SPECIFICATION: RFC 865

COMMENTS:

Debugging protocol, sends you a short ASCII message.

OTHER REFERENCES:

DEPENDENCIES: Transmission Control Protocol
or User Datagram Protocol

CONTACT: Postel@USC-ISIF.ARPA

Active Users Protocol -------------------------------------- (USERS)

STATUS: Elective

SPECIFICATION: RFC 866

COMMENTS:

Lists the currently active users.

OTHER REFERENCES:

DEPENDENCIES: Transmission Control Protocol
or User Datagram Protocol

CONTACT: Postel@USC-ISIF.ARPA

Finger Protocol --- (FINGER)

STATUS: Elective

SPECIFICATION: RFC 742 (in APH)

COMMENTS:

Provides information on the current or most recent activity of a user.

Some extensions have been suggested.

Some changes are are needed for TCP.

OTHER REFERENCES:

DEPENDENCIES: Transmission Control Protocol

CONTACT: Postel@USC-ISIF.ARPA

WhoIs Protocol -- (NICNAME)

STATUS: Elective

SPECIFICATION: RFC 812 (in IPTW)

COMMENTS:

Accesses the ARPANET Directory database. Provides a way to find out about people, their addresses, phone numbers, organizations, and mailboxes.

OTHER REFERENCES:

DEPENDENCIES: Transmission Control Protocol

CONTACT: Feinler@SRI-NIC.ARPA

Domain Name Protocol ------------------------------------- (DOMAIN)

STATUS: Experimental

SPECIFICATION: RFC 881, 882, 883

COMMENTS:

OTHER REFERENCES:

RFC 920 - Domain Requirements

RFC 921 - Domain Name Implementation Schedule - Revised

DEPENDENCIES: Transmission Control Protocol
or User Datagram Protocol

CONTACT: Mockapetris@USC-ISIF.ARPA

HOSTNAME Protocol -- (HOSTNAME)

STATUS: Elective

SPECIFICATION: RFC 811 (in IPTW)

COMMENTS:

Accesses the Registered Internet Hosts database (HOSTS.TXT). Provides a way to find out about a host in the Internet, its Internet Address, and the protocols it implements.

OTHER REFERENCES:

RFC 810 - Host Table Specification

DEPENDENCIES: Transmission Control Protocol

CONTACT: Feinler@SRI-NIC.ARPA

Host Name Server Protocol ----------------------------- (NAMESERVER)

STATUS: Experimental

SPECIFICATION: IEN 116 (in IPTW)

COMMENTS:

Provides machine oriented procedure for translating a host name to an Internet Address.

This specification has significant problems: 1) The name syntax is out of date. 2) The protocol details are ambiguous, in particular, the length octet either does or doesn't include itself and the op code. 3) The extensions are not supported by any known implementation.

This protocol is now abandon in favor of the DOMAIN protocol. Further implementations of this protocol are not advised.

Please discuss any plans for implementation or use of this protocol with the contact.

OTHER REFERENCES:

DEPENDENCIES: User Datagram Protocol

CONTACT: Postel@USC-ISIF.ARPA

CSNET Mailbox Name Server Protocol ---------------------- (CSNET-NS)

STATUS: Experimental

SPECIFICATION: CS-DN-2

COMMENTS:

Provides access to the CSNET data base of users to give information about users names, affiliations, and mailboxes.

Please discuss any plans for implementation or use of this protocol with the contact.

OTHER REFERENCES:

DEPENDENCIES: Transmission Control Protocol

CONTACT: Solomon@UWISC.ARPA

Daytime Protocol -- (DAYTIME)

STATUS: Elective

SPECIFICATION: RFC 867

COMMENTS:

Provides the day and time in ASCII character string.

OTHER REFERENCES:

DEPENDENCIES: Transmission Control Protocol
or User Datagram Protocol

CONTACT: Postel@USC-ISIF.ARPA

Time Server Protocol -- (TIME)

STATUS: Elective

SPECIFICATION: RFC 868

COMMENTS:

Provides the time as the number of seconds from a specified reference time.

OTHER REFERENCES:

DEPENDENCIES: Transmission Control Protocol
or User Datagram Protocol

CONTACT: Postel@USC-ISIF.ARPA

DCNET Time Server Protocol ---------------------------------- (CLOCK)

STATUS: Elective

SPECIFICATION: RFC 778

COMMENTS:

Provides a mechanism for keeping synchronized clocks.

OTHER REFERENCES:

DEPENDENCIES: Internet Control Message Protocol

CONTACT: Mills@USC-ISID.ARPA

SUPDUP Protocol --- (SUPDUP)

STATUS: Elective

SPECIFICATION: RFC 734 (in APH)

COMMENTS:

A special Telnet like protocol for display terminals.

OTHER REFERENCES:

DEPENDENCIES: Transmission Control Protocol

CONTACT: Crispin@SU-SCORE.ARPA

Internet Message Protocol --------------------------------------- (MPM)

STATUS: Experimental

SPECIFICATION: RFC 759

COMMENTS:

This is an experimental multimedia mail transfer protocol. The implementation is called a Message Processing Module or MPM.

Please discuss any plans for implementation or use of this protocol with the contact.

OTHER REFERENCES:

RFC 767 - Structured Document Formats

DEPENDENCIES: Transmission Control Protocol

CONTACT: Postel@USC-ISIF.ARPA

Post Office Protocol - Version 2 ---------------------------- (POP2)

STATUS: Experimental

SPECIFICATION: RFC 937

COMMENTS:

The intent of the Post Office Protocol - Version 2 (POP2) is to allow a user's workstation to access mail from a mailbox server. It is expected that mail will be posted from the workstation to the mailbox server via the Simple Mail Transfer Protocol (SMTP).

Please discuss any plans for implementation or use of this protocol with the contact.

OTHER REFERENCES: Obsoletes RFC 918

DEPENDENCIES: Transmission Control Protocol

CONTACT: JKReynolds@USC-ISIF.ARPA

Network Standard Text Editor ------------------------------- (NETED)

STATUS: Elective

SPECIFICATION: RFC 569

COMMENTS:

Describes a simple line editor which could be provided by every Internet host.

OTHER REFERENCES:

DEPENDENCIES:

CONTACT: Postel@USC-ISIF.ARPA

Authentication Service ------------------------------------- (AUTH)

STATUS: Experimental

SPECIFICATION: RFC 931

COMMENTS:

This server provides a means to determine the identity of a user of a particular TCP connection. Given a TCP port number pair, it returns a character string which identifies the owner of that connection on the server's system.

Please discuss any plans for implementation or use of this protocol with the contact.

OTHER REFERENCES: Supercedes RFC 912

DEPENDENCIES: Transmission Control Protocol

CONTACT: StJohns@MIT-Multics.ARPA

APPENDICES

Assigned Numbers ---

STATUS: None

SPECIFICATION: RFC 943

COMMENTS:

Describes the fields of various protocols that are assigned specific values for actual use, and lists the currently assigned values.

Issued April 1985, replaces RFC 923, RFC 790 in IPTW, and RFC 900.

OTHER REFERENCES:

CONTACT: JKReynolds@USC-ISIF.ARPA

Pre-emption ---

STATUS: Elective

SPECIFICATION: RFC 794 (in IPTW)

COMMENTS:

Describes how to do pre-emption of TCP connections.

OTHER REFERENCES:

CONTACT: Postel@USC-ISIF.ARPA

Service Mappings ---

STATUS: None

SPECIFICATION: RFC 795 (in IPTW)

COMMENTS:

Describes the mapping of the IP type of service field onto the parameters of some specific networks.

Out of date, needs revision.

OTHER REFERENCES:

CONTACT: Postel@USC-ISIF.ARPA

Address Mappings ---

STATUS: None

SPECIFICATION: RFC 796 (in IPTW)

COMMENTS:

Describes the mapping between Internet Addresses and the addresses of some specific networks.

Out of date, needs revision.

OTHER REFERENCES:

CONTACT: Postel@USC-ISIF.ARPA

Document Formats ---

STATUS: None

SPECIFICATION: RFC 678

COMMENTS:

Describes standard format rules for several types of documents.

OTHER REFERENCES:

CONTACT: Postel@USC-ISIF.ARPA

Bitmap Formats ---

STATUS: None

SPECIFICATION: RFC 797

COMMENTS:

Describes a standard format for bitmap data.

OTHER REFERENCES:

CONTACT: Postel@USC-ISIF.ARPA

Facsimile Formats --

STATUS: None

SPECIFICATION: RFC 804

COMMENTS:

Describes a standard format for facsimile data.

OTHER REFERENCES:

CONTACT: Postel@USC-ISIF.ARPA

Host-Front End Protocol -------------------------------------- (HFEP)

STATUS: Experimental

SPECIFICATION: RFC 929

COMMENTS:

Please discuss any plans for implementation or use of this protocol with the contact.

OTHER REFERENCES: RFC 928

DEPENDENCIES:

CONTACT: Padlipsky@USC-ISI.ARPA

Internet Protocol on X.25 Networks ------------------------ (IP-X25)

STATUS: Recommended

SPECIFICATION: RFC 877

COMMENTS:

Describes a standard for the transmission of IP Datagrams over Public Data Networks.

OTHER REFERENCES:

CONTACT: jtk@PURDUE.ARPA

Internet Protocol on DC Networks --------------------------- (IP-DC)

STATUS: Elective

SPECIFICATION: RFC 891

COMMENTS:

OTHER REFERENCES:

RFC 778 - DCNET Internet Clock Service

CONTACT: Mills@USC-ISID.ARPA

Internet Protocol on Ethernet Networks ---------------------- (IP-E)

STATUS: Recommended

SPECIFICATION: RFC 894

COMMENTS:

OTHER REFERENCES: RFC 893

CONTACT: Postel@USC-ISIF.ARPA

Internet Protocol on Experimental Ethernet Networks -------- (IP-EE)

STATUS: Recommended

SPECIFICATION: RFC 895

COMMENTS:

OTHER REFERENCES:

CONTACT: Postel@USC-ISIF.ARPA

Internet Subnets Protocol ---------------------------------- (IP-SUB)

STATUS: Experimental

SPECIFICATION: RFC 940

COMMENTS:

Discussion of the various problems and potential solutions of "explicit subnets" in a multi-LAN environment.

Please discuss any plans for implementation or use of this protocol with the contact.

OTHER REFERENCES: RFC 917, RFC 925, RFC 932, RFC 936, RFC 922

DEPENDENCIES:

CONTACT: Mills@USC-ISID.ARPA

Broadcasting Internet Datagrams ------------------------- (IP-BROAD)

STATUS: Experimental

SPECIFICATION: RFC 919

COMMENTS:

A proposed protocol of simple rules for broadcasting Internet datagrams on local networks that support broadcast, for addressing broadcasts, and for how gateways should handle them.

Please discuss any plans for implementation or use of this protocol with the contact.

OTHER REFERENCES: RFC 922

DEPENDENCIES:

CONTACT: Mogul@SU-SCORE.ARPA

Address Resolution Protocol ---------------------------------- (ARP)

STATUS: Recommended

SPECIFICATION: RFC 826

COMMENTS:

This is a procedure for finding the network hardware address corresponding to an Internet Address.

OTHER REFERENCES:

CONTACT: Postel@USC-ISIF.ARPA

A Reverse Address Resolution Protocol ---------------------- (RARP)

STATUS: Elective

SPECIFICATION: RFC 903

COMMENTS:

This is a procedure for workstations to dynamically find their protocol address (e.g., their Internet Address), when they only only know their hardware address (e.g., their attached physical network address).

OTHER REFERENCES:

CONTACT: Mogul@SU-SCORE.ARPA

Multi-LAN Address Resolution Protocol ---------------------- (MARP)

STATUS: Experimental

SPECIFICATION: RFC 925

COMMENTS:

Discussion of the various problems and potential solutions of "transparent subnets" in a multi-LAN environment.

Please discuss any plans for implementation or use of this protocol with the contact.

OTHER REFERENCES: RFC 917, RFC 826

DEPENDENCIES:

CONTACT: Postel@USC-ISIF.ARPA

Broadcasting Internet Datagrams with Subnets --------- (IP-SUB-BROAD)

STATUS: Experimental

SPECIFICATION: RFC 922

COMMENTS:

A proposed protocol of simple rules for broadcasting Internet datagrams on local networks that support broadcast, for addressing broadcasts, and for how gateways should handle them.

Please discuss any plans for implementation or use of this protocol with the contact.

OTHER REFERENCES:

DEPENDENCIES:

CONTACT: Mogul@SU-SCORE.ARPA

Host Access Protocol -- (HAP)

STATUS: Recommended

SPECIFICATION: RFC 907

COMMENTS:

This protocol specifies the network-access level communication between an arbitrary computer, called a host, and a packet-switched satellite network, e.g., SATNET or WBNET.

Note: Implementations of HAP should be performed in coordination with satellite network development and operations personnel.

OTHER REFERENCES:

DEPENDENCIES:

CONTACT: Schoen@BBN-UNIX.ARPA

Reliable Asynchronous Transfer Protocol -------------------- (RATP)

STATUS: Experimental

SPECIFICATION: RFC 916

COMMENTS:

This paper specifies a protocol which allows two programs to reliably communicate over a communication link. It ensures that the data entering one end of the link if received arrives at the other end intact and unaltered. This proposed protocol is designed to operate over a full duplex point-to-point connection. It contains some features which tailor it to the RS-232 links now in current use.

Please discuss any plans for implementation or use of this protocol with the contact.

OTHER REFERENCES:

DEPENDENCIES: Transmission Control Protocol

CONTACT: Finn@USC-ISIF.ARPA

Thinwire Protocol -- (THINWIRE)

STATUS: Experimental

SPECIFICATION: RFC 914

COMMENTS:

This paper discusses a Thinwire Protocol for connecting personal computers to the ARPA-Internet. It primarily focuses on the particular problems in the ARPA-Internet of low speed network interconnection with personal computers, and possible methods of solution.

Please discuss any plans for implementation or use of this protocol with the contact.

OTHER REFERENCES:

DEPENDENCIES:

CONTACT: Farber@ROCHESTER.ARPA

Reliable Asynchronous Transfer Protocol ---------------------- (RATP)

STATUS: Experimental

SPECIFICATION: RFC 916

COMMENTS:

This paper specifies a protocol which allows two programs to reliably communicate over a communication link. It ensures that the data entering one end of the link if received arrives at the other end intact and unaltered. This proposed protocol is designed to operate over a full duplex point-to-point connection. It contains some features which tailor it to the RS-232 links now in current use.

Please discuss any plans for implementation or use of this protocol with the contact.

OTHER REFERENCES:

RFC-793(TCP), Transmission Control Protocol

CONTACT: Finn@USC-ISIB.ARPA

Thinwire Protocol -- (THINWIRE)

STATUS: Experimental

SPECIFICATION: RFC 914

COMMENTS:

This paper discusses a Thinwire Protocol for connecting personal computers to the ARPA-Internet. It primarily focuses on the particular problems in the ARPA-Internet of low speed network interconnection with personal computers, and possible methods of solution.

Please discuss any plans for implementation or use of this protocol with the contact.

OTHER REFERENCES:

[illegible]

CONTACT: [illegible]